Simulation of Galactic Cosmic Rays and dose-rate effects in RITRACKS

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The NASA Space Radiation Laboratory (NSRL) facility has been used successfully for many years to generate ion beams for radiation research experiments by NASA investigators. Recently, modifications were made to the beam lines to allow rapid switching between different types of ions and energies, with the aim to simulate the Galactic Cosmic Rays (GCR) environment. As this will be a focus of space radiation research for upcoming years, the stochastic radiation track structure code RITRACKS (Relativistic Ion Tracks) [1] was modified to simulate beams of various ion types and energies during time intervals specified by the user at the microscopic and nanoscopic scales. For example, particle distributions of a mixed 344.1-MeV protons (18.04 cGy) and 950-MeV/n iron (5.64 cGy) beam behind a 20 g/cm^2 aluminum followed by a 10 g/cm^2 polyethylene shield as calculated by the code GEANT4 were used as an input field in RITRACKS. Similarly, modifications were also made to simulate a realistic radiation environment in a spacecraft exposed to GCR by sampling the ion types and energies from particle spectra pre-calculated by the code HZETRN. The newly implemented features allows RITRACKS to generate time-dependent differential and cumulative 3D dose voxel maps [2]. These new capabilities of RITRACKS will be used to investigate dose-rate effects and synergistic interactions of various types of radiations for many end points at the microscopic and nanoscopic scales such as DNA damage and chromosome aberrations.

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